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(71) Applicant *(for all designated States except US)*: **THE PROCTER & GAMBLE COMPANY** [US/US]; One Procter & Gamble Plaza, Cincinnati, OH 45202 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **VENKATESWARAN, Ananthanarayan** [IN/JP]; 1-4-127-904, Koyo-cho Naka, Higashinada-ku, Kobe 658-0032 (JP). **YANG, Jian-Zhong** [CN/JP]; 2-1-215-727, Koyo-cho Naka 1-chome, Higashinada-ku, Kobe 658-0032 (JP).

(74) Agents: **REED, T., David** et al.; The Procter & Gamble Company, 5299 Spring Grove Avenue, Cincinnati, OH 45217-1087 (US).

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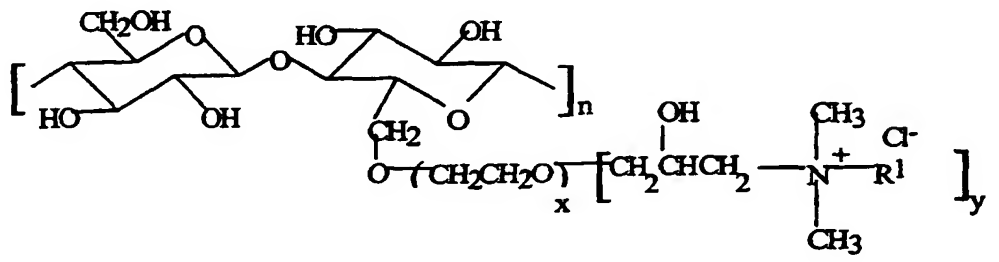

(1)

(57) Abstract: Disclosed is a hair conditioning composition comprising by weight: (a) from about 0.1 % to about 5 % of a hydrophobically modified cationic cellulose having formula (1): wherein R^1 is an alkyl having from about 8 to about 22 carbons, n is an integer from 1 to about 2000; x is 0 or an integer from 1 to about 6; y is the level of cationic substitution from 0.1 to 1.0; and having a molecular weight of no more than about 1,000,000; (b) from about 0.01 % to about 20 % of a conditioning agent; and (c) an aqueous carrier, wherein the hair conditioning composition increases bulk hair volume by a Volume Index of 20 or greater as measured by Instron Volume Measurement Method.

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HAIR CONDITIONING COMPOSITION COMPRISING HYDROPHOBICALLY MODIFIED CATIONIC CELLULOSE

TECHNICAL FIELD

The present invention relates to a hair conditioning composition containing a hydrophobically modified cationic cellulose.

BACKGROUND

Human hair becomes soiled due to its contact with the surrounding environment and from the sebum secreted by the scalp. The soiling of hair causes it to have a dirty feel and an unattractive appearance. The soiling of the hair necessitates shampooing with frequent regularity.

Shampooing cleans the hair by removing excess soil and sebum. However, shampooing can leave the hair in a wet, tangled, and generally unmanageable state. Once the hair dries, it is often left in a dry, rough, lusterless, or frizzy condition due to removal of the hair's natural oils and other natural conditioning and moisturizing components. The hair can further be left with increased levels of static upon drying, which can interfere with combing and result in a condition commonly referred to as "fly-away hair", or contribute to an undesirable phenomena of "split ends", particularly for long hair.

A variety of approaches have been developed to condition the hair. These approaches range from post-shampoo application of hair conditioners such as leave-on and rinse-off products, to hair conditioning shampoos which attempt to both clean and condition the hair from a single product.

Although some consumers prefer the ease and convenience of a shampoo which includes conditioners, a substantial proportion of consumers prefer the more conventional conditioner formulations which are applied to the hair as a separate step from shampooing, usually subsequent to shampooing. Conditioning formulations can be in the form of rinse-off products or leave-on products, and can be in the form of an emulsion, cream, gel, spray, and mousse. Such consumers who prefer the conventional conditioner formulations value the

relatively higher conditioning effect, or convenience of changing the amount of conditioning depending on the condition of hair or amount of hair.

A common method of providing conditioning benefit to the hair is through the use of hair conditioning agents such as cationic surfactants and polymers, high melting point fatty compounds, low melting point oils, silicone compounds, and mixtures thereof. Most of these conditioning agents are known to provide various conditioning benefits such as moisturized feel, softness, and static control to the hair , however, are also known to weigh down the hair and provide stickiness or greasy or waxy feeling.

Hair conditioning compositions comprising the conditioning agent described above, can provide conditioning benefits such as softness and moisturized feel on dry hair, however, also weigh down the hair. The weighed down hair gives an appearance of reduced bulk hair volume. For consumers who desire hair volume-up such as consumers having fine hair, the effect of hair weighing down is not desirable. The term "hair volume-up" as used herein is not equal to fly-away hair. Fly-away hair is due to the increased level of static, and represents volume increase of only very minor amount of the hair as a whole, and is not desirable. On the other hand, hair volume-up as used herein relates to increase of the bulk of the hair volume. Consumers having fine hair have the desire to achieve hair volume-up while controlling undesirable fly-away of the hair.

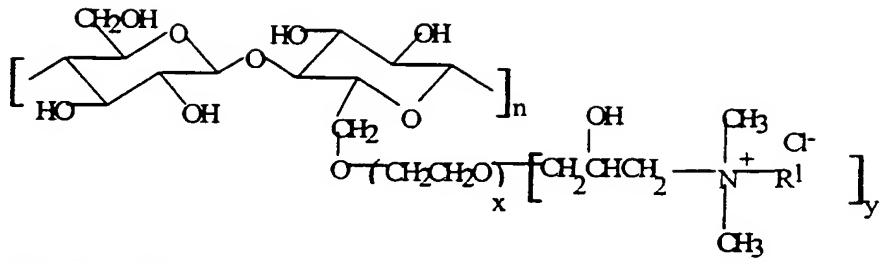
Based on the foregoing, there remains a desire to provide hair conditioning compositions which provide hair volume-up while not deteriorating conditioning benefits such as softness, moisturized feel, and fly-away control.

None of the existing art provides all of the advantages and benefits of the present invention.

SUMMARY

The present invention is directed to a hair conditioning composition comprising by weight:

(a) from about 0.1% to about 5% of a hydrophobically modified cationic cellulose having the following formula:



wherein R^1 is an alkyl having from about 8 to about 22 carbons, n is an integer from 1 to about 4,000; x is 0 or an integer from 1 to about 6; y is the level of cationic substitution from 0.1 to 1.0; and having a molecular weight of no more than about 1,000,000;

(b) from about 0.01% to about 20% of a conditioning agent; and

(c) an aqueous carrier,

wherein the hair conditioning composition increases bulk hair volume by a Volume Index of 20 or greater as measured by Instron Volume Measurement Method.

These and other features, aspects, and advantages of the present invention will become evident to those skilled in the art from a reading of the present disclosure.

BRIEF DESCRIPTION OF THE FIGURE

While the specification concludes with claims particularly pointing out and distinctly claiming the invention, it is believed that the present invention will be better understood from the following description of preferred, nonlimiting embodiments and representations taken in conjunction with the accompanying drawings in which:

Fig. 1 is a side view of a preferred embodiment of the Instron Volume Measurement Equipment.

DETAILED DESCRIPTION

While the specification concludes with claims particularly pointing and distinctly claiming the invention, it is believed the present invention will be better understood from the following description.

All percentages are by weight of the total composition unless otherwise indicated. All ratios are weight ratios unless otherwise indicated. All percentages, ratios, and levels of ingredients referred to herein are based on the actual amount of the ingredient, and do not include solvents, fillers, or other

materials with which the ingredient may be combined as commercially available products, unless otherwise indicated.

As used herein, "comprising" means that other steps and other ingredients which do not affect the end result can be added. This term encompasses the terms "consisting of" and "consisting essentially of".

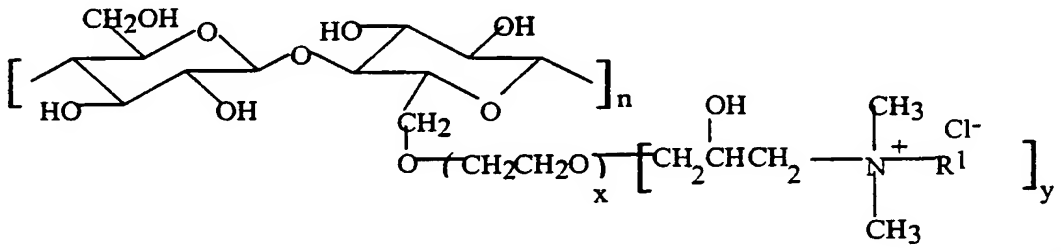
All cited references are incorporated herein by reference in their entireties. Citation of any reference is not an admission regarding any determination as to its availability as prior art to the claimed invention.

HYDROPHOBICALLY MODIFIED CATIONIC CELLULOSE

The hair conditioning composition of the present invention comprises a hydrophobically modified cationic cellulose. The hydrophobically modified cationic celluloses herein provides increase in bulk hair volume while not deteriorating conditioning benefits such as fly-away control. Hydrophobically modified cationic cellulose is typically included in the hair styling compositions as an antistatic agent, a film former, or a hair fixative. It has been surprisingly found that when hydrophobically modified cationic celluloses is included in the hair conditioning composition, increase in bulk hair volume is significantly improved.

The hair conditioning composition of the present invention comprises by weight from about 0.1% to about 5%, preferably from about 0.2% to about 1.0%, more preferably from about 0.25% to about 0.5% of a hydrophobically modified cationic cellulose.

The hydrophobically modified cationic celluloses useful in the present invention are those having the following formula:



wherein R^1 is an alkyl having from about 8 to about 22 carbons, preferably from about 10 to about 18 carbons; n is an integer from 1 to about 4,000, preferably from about 100 to about 1,000; x is 0 or an integer from 1 to about 6, preferably from about 1 to about 3; and y is the level of cationic substitution from 0.1 to 1.0. The hydrophobically modified cationic celluloses useful in the present invention

must have a molecular weight of no more than about 1,000,000, preferably from about 250,000 to about 500,000.

Commercially available hydrophobically modified cationic celluloses include, for example, the polymeric quaternary ammonium salts of hydroxyethyl cellulose reacted with lauryl dimethyl ammonium-substituted epoxide, referred to in the industry (CTFA) as Polyquaternium 24, available from Amerchol Corp. (Edison, NJ, USA) under the tradename Polymer LM-200®.

Hydrophobically modified cationic celluloses of the present invention are compatible with conditioning agents such as high melting point fatty compounds, low melting point fatty compounds, cationic surfactants, cationic polymers, and silicone compounds, which are included in conditioning compositions to provide favorable conditioning and texture. Thus, these hydrophobically modified cationic celluloses can be incorporated into a wide variety of hair conditioning compositions, and, together with the conditioning agents, can provide increase in bulk hair volume in addition to conditioning benefits such as softness, moisturized feel, and fly-away control.

CONDITIONING AGENT

The hair conditioning composition of the present invention comprises by weight from about 0.01% to about 20% of a conditioning agent. The conditioning agent, together with the hydrophobically modified cationic cellulose, can provide various conditioning benefits such as softness, moisturized feel, and fly-away control. Preferably, the conditioning agent is selected from the group consisting of high melting point fatty compounds having a melting point of 25°C or higher, low melting point oils having a melting point of less than 25°C, cationic surfactants, cationic polymers, silicone compounds, cationic silicone emulsions and mixtures thereof. More preferably, the conditioning agent comprises a cationic silicone emulsion comprising the silicone compounds and the cationic surfactants. More preferably, the conditioning agent comprises the high melting point fatty compounds and the cationic surfactants, which provide a gel network together with an aqueous carrier.

High melting point fatty compound

The hair conditioning composition of the present invention preferably comprises a high melting point fatty compound. The high melting fatty compound, together with a cationic surfactant and an aqueous carrier, provide a gel network which is suitable for providing various conditioning benefits such as

slippery and slick feel on wet hair, and softness, moisturized feel, and fly-away control on dry hair.

The high melting point fatty compound useful herein have a melting point of 25°C or higher, and is selected from the group consisting of fatty alcohols, fatty acids, fatty alcohol derivatives, fatty acid derivatives, and mixtures thereof. It is understood by the artisan that the compounds disclosed in this section of the specification can in some instances fall into more than one classification, *e.g.*, some fatty alcohol derivatives can also be classified as fatty acid derivatives. However, a given classification is not intended to be a limitation on that particular compound, but is done so for convenience of classification and nomenclature. Further, it is understood by the artisan that, depending on the number and position of double bonds, and length and position of the branches, certain compounds having certain required carbon atoms may have a melting point of less than 25°C. Such compounds of low melting point are not intended to be included in this section. Nonlimiting examples of the high melting point compounds are found in International Cosmetic Ingredient Dictionary, Fifth Edition, 1993, and CTFA Cosmetic Ingredient Handbook, Second Edition, 1992.

The high melting point fatty compound can be included in the composition at a level by weight of, preferably from about 0.1% to about 15%, more preferably from about 0.5% to about 10%, still more preferably from about 1% to about 7%.

The fatty alcohols useful herein are those having from about 14 to about 30 carbon atoms, preferably from about 16 to about 22 carbon atoms. These fatty alcohols are saturated and can be straight or branched chain alcohols. Nonlimiting examples of fatty alcohols include, cetyl alcohol, stearyl alcohol, behenyl alcohol, and mixtures thereof.

The fatty acids useful herein are those having from about 10 to about 30 carbon atoms, preferably from about 12 to about 22 carbon atoms, and more preferably from about 16 to about 22 carbon atoms. These fatty acids are saturated and can be straight or branched chain acids. Also included are diacids, triacids, and other multiple acids which meet the requirements herein. Also included herein are salts of these fatty acids. Nonlimiting examples of fatty acids include lauric acid, palmitic acid, stearic acid, behenic acid, sebacic acid, and mixtures thereof.

The fatty alcohol derivatives and fatty acid derivatives useful herein include alkyl ethers of fatty alcohols, alkoxylated fatty alcohols, alkyl ethers of alkoxylated fatty alcohols, esters of fatty alcohols, fatty acid esters of compounds having esterifiable hydroxy groups, hydroxy-substituted fatty acids, and mixtures thereof. Nonlimiting examples of fatty alcohol derivatives and fatty acid derivatives include materials such as methyl stearyl ether; the ceteth series of compounds such as ceteth-1 through ceteth-45, which are ethylene glycol ethers of cetyl alcohol, wherein the numeric designation indicates the number of ethylene glycol moieties present; the steareth series of compounds such as steareth-1 through 10, which are ethylene glycol ethers of steareth alcohol, wherein the numeric designation indicates the number of ethylene glycol moieties present; ceteareth 1 through ceteareth-10, which are the ethylene glycol ethers of ceteareth alcohol, *i.e.* a mixture of fatty alcohols containing predominantly cetyl and stearyl alcohol, wherein the numeric designation indicates the number of ethylene glycol moieties present; C_1-C_{30} alkyl ethers of the ceteth, steareth, and ceteareth compounds just described; polyoxyethylene ethers of behenyl alcohol; ethyl stearate, cetyl stearate, cetyl palmitate, stearyl stearate, myristyl myristate, polyoxyethylene cetyl ether stearate, polyoxyethylene stearyl ether stearate, polyoxyethylene lauryl ether stearate, ethyleneglycol monostearate, polyoxyethylene monostearate, polyoxyethylene distearate, propyleneglycol monostearate, propyleneglycol distearate, trimethylolpropane distearate, sorbitan stearate, polyglyceryl stearate, glyceryl monostearate, glyceryl distearate, glyceryl tristearate, and mixtures thereof.

High melting point fatty compounds of a single compound of high purity are preferred. Single compounds of pure fatty alcohols selected from the group of pure cetyl alcohol, stearyl alcohol, and behenyl alcohol are highly preferred. By "pure" herein, what is meant is that the compound has a purity of at least about 90%, preferably at least about 95%. These single compounds of high purity provide good rinsability from the hair when the consumer rinses off the composition.

Commercially available high melting point fatty compounds useful herein include: cetyl alcohol, stearyl alcohol, and behenyl alcohol having tradenames KONOL series available from Shin Nihon Rika (Osaka, Japan), and NAA series available from NOF (Tokyo, Japan); pure behenyl alcohol having tradename 1-DOCOSANOL available from WAKO (Osaka, Japan), various fatty acids having

tradenames NEO-FAT available from Akzo (Chicago Illinois, USA), HYSTRENE available from Witco Corp. (Dublin Ohio, USA), and DERMA available from Vevy (Genova, Italy).

Low melting point oil

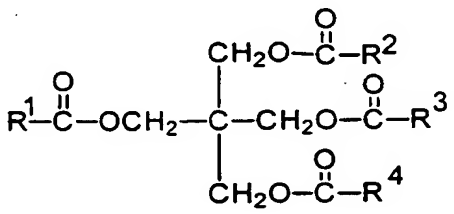
The low melting point oil useful herein has a melting point of less than 25°C, and can be included in the composition at a level by weight of, preferably from about 0.1% to about 10%, more preferably from about 0.25% to about 6%.

The low melting point oil useful herein is selected from the group consisting of hydrocarbon having from 10 to about 40 carbon atoms, unsaturated fatty alcohols having from about 10 to about 30 carbon atoms, unsaturated fatty acids having from about 10 to about 30 carbon atoms, fatty acid derivatives, fatty alcohol derivatives, ester oils, poly α-olefin oils, and mixtures thereof.

Fatty alcohols useful herein include those having from about 10 to about 30 carbon atoms, preferably from about 12 to about 22 carbon atoms, and more preferably from about 16 to about 22 carbon atoms. These fatty alcohols are unsaturated and can be straight or branched chain alcohols. Suitable fatty alcohols include, for example, oleyl alcohol, isostearyl alcohol, tridecylalcohol, decyl tetradecyl alcohol, and octyl dodecyl alcohol. These alcohols are available, for example, from Shinnihon Rika.

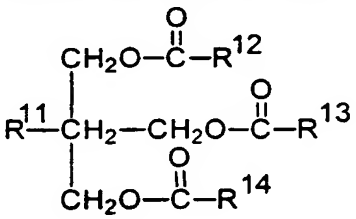
Low melting point oils useful herein include pentaerythritol ester oils, trimethylol ester oils, poly α-olefin oils, citrate ester oils, glyceryl ester oils, and mixtures thereof, and the ester oil useful herein is water-insoluble. As used herein, the term "water-insoluble" means the compound is substantially not soluble in water at 25°C; when the compound is mixed with water at a concentration by weight of above 1.0%, preferably at above 0.5%, the compound is temporarily dispersed to form an unstable colloid in water, then is quickly separated from water into two phases.

Pentaerythritol ester oils useful herein are those having the following formula:



wherein R^1, R^2, R^3, and R^4, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 1 to about 30 carbons. Preferably, R^1, R^2, R^3, and R^4, independently, are branched, straight, saturated, or unsaturated alkyl groups having from about 8 to about 22 carbons. More preferably, R^1, R^2, R^3 and R^4 are defined so that the molecular weight of the compound is from about 800 to about 1200.

Trimethylol ester oils useful herein are those having the following formula:



wherein R^{11} is an alkyl group having from 1 to about 30 carbons, and R^{12}, R^{13}, and R^{14}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 1 to about 30 carbons. Preferably, R^{11} is ethyl and R^{12}, R^{13}, and R^{14}, independently, are branched, straight, saturated, or unsaturated alkyl groups having from 8 to about 22 carbons. More preferably, R^{11}, R^{12}, R^{13} and R^{14} are defined so that the molecular weight of the compound is from about 800 to about 1200.

Particularly useful pentaerythritol ester oils and trimethylol ester oils herein include pentaerythritol tetraisostearate, pentaerythritol tetraoleate, trimethylolpropane triisostearate, trimethylolpropane trioleate, and mixtures thereof. Such compounds are available from Kokyo Alcohol with tradenames KAKPTI, KAKTTI, and Shin-nihon Rika with tradenames PTO, ENUJERUBU TP3SO.

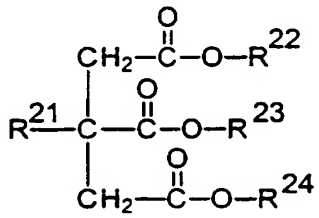
Poly α-olefin oils useful herein are those derived from 1-alkene monomers having from about 6 to about 16 carbons, preferably from about 6 to about 12 carbons atoms. Nonlimiting examples of 1-alkene monomers useful for preparing the poly α-olefin oils include 1-hexene, 1-octene, 1-decene, 1-dodecene, 1-tetradecene, 1-hexadecene, branched isomers such as 4-methyl-1-pentene, and mixtures thereof. Preferred 1-alkene monomers useful for preparing the poly α-olefin oils are 1-octene, 1-decene, 1-dodecene, 1-tetradecene, 1-hexadecene, and mixtures thereof. Poly α-olefin oils useful herein further have a viscosity of from about 1 to about 35,000 cst, a molecular

weight of from about 200 to about 60,000, and a polydispersity of no more than about 3.

Poly α-olefin oils having a molecular weight of at least about 800 are useful herein. Such high molecular weight poly α-olefin oils are believed to provide long lasting moisturized feel to the hair. Poly α-olefin oils having a molecular weight of less than about 800 are useful herein. Such low molecular weight poly α-olefin oils are believed to provide a smooth, light, clean feel to the hair.

Particularly useful poly α-olefin oils herein include polydecenes with tradenames PURESYN 6 having a number average molecular weight of about 500 and PURESYN 100 having a number average molecular weight of about 3000 and PURESYN 300 having a number average molecular weight of about 6000 available from Mobil Chemical Co.

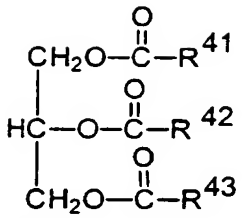
Citrate ester oils useful herein are those having a molecular weight of at least about 500 having the following formula:



wherein R^{21} is OH or CH_3COO, and R^{22}, R^{23}, and R^{24}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 1 to about 30 carbons. Preferably, R^{21} is OH, and R^{22}, R^{23}, and R^{24}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 8 to about 22 carbons. More preferably, R^{21}, R^{22}, R^{23} and R^{24} are defined so that the molecular weight of the compound is at least about 800.

Particularly useful citrate ester oils herein include triisocetyl citrate with tradename CITMOL 316 available from Bernel, triisostearyl citrate with tradename PELEMOL TISC available from Phoenix, and trioctyldodecyl citrate with tradename CITMOL 320 available from Bernel.

Glyceryl ester oils useful herein are those having a molecular weight of at least about 500 and having the following formula:



wherein R^{41}, R^{42}, and R^{43}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 1 to about 30 carbons. Preferably, R^{41}, R^{42}, and R^{43}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 8 to about 22 carbons. More preferably, R^{41}, R^{42}, and R^{43} are defined so that the molecular weight of the compound is at least about 800.

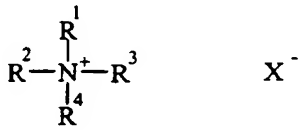
Particularly useful glyceryl ester oils herein include triisostearin with tradename SUN ESPOL G-318 available from Taiyo Kagaku, triolein with tradename CITHROL GTO available from Croda Surfactants Ltd., trilinolein with tradename EFADERMA-F available from Vevy, or tradename EFA-GLYCERIDES from Brooks.

Cationic surfactant

The hair conditioning composition of the present invention preferably comprises a cationic surfactant. The cationic surfactant, together with a high melting point fatty compound and an aqueous carrier, provide a gel network which is suitable for providing various conditioning benefits such as slippery and slick feel on wet hair, and softness, moisturized feel, and fly-away control on dry hair.

The cationic surfactant useful herein is any known to the artisan, and can be included in the composition at a level by weight of, preferably from about 0.1% to about 10%, more preferably from about 0.25% to about 8%, still more preferably from about 0.5 to about 3%.

Among the cationic surfactants useful herein are those corresponding to the general formula (I):



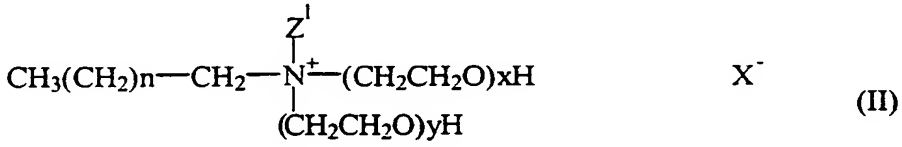
(I)

wherein at least one of R^1, R^2, R^3, and R^4 is selected from an aliphatic group of from 8 to 30 carbon atoms or an aromatic, alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to about 22 carbon atoms, the remainder of R^1, R^2, R^3, and R^4 are independently selected from an aliphatic group of from 1 to about 22 carbon atoms or an aromatic, alkoxy, polyoxyalkylene, alkylamido, hydroxyalkyl, aryl or alkylaryl group having up to about 22 carbon atoms; and X is a salt-forming anion such as those selected from halogen, (e.g. chloride, bromide), acetate, citrate, lactate, glycolate, phosphate, nitrate, sulfonate, sulfate, alkylsulfate, and alkyl sulfonate radicals. The aliphatic groups can contain, in addition to carbon and hydrogen atoms, ether linkages, and other groups such as amino groups. The longer chain aliphatic groups, e.g., those of about 12 carbons, or higher, can be saturated or unsaturated. Preferred is when R^1, R^2, R^3, and R^4 are independently selected from C_1 to about C_{22} alkyl. Nonlimiting examples of cationic surfactants useful in the present invention include the materials having the following CTFA designations: quaternium-8, quaternium-14, quaternium-18, quaternium-18 methosulfate, quaternium-24, and mixtures thereof.

Among the cationic surfactants of general formula (I), preferred are those containing in the molecule at least one alkyl chain having at least 16 carbons. Nonlimiting examples of such preferred cationic surfactants include: behenyl trimethyl ammonium chloride available, for example, with tradename INCROQUAT TMC-80 from Croda and ECONOL TM22 from Sanyo Kasei; cetyl trimethyl ammonium chloride available, for example, with tradename CA-2350 from Nikko Chemicals, hydrogenated tallow alkyl trimethyl ammonium chloride, dialkyl (14-18) dimethyl ammonium chloride, ditallow alkyl dimethyl ammonium chloride, dihydrogenated tallow alkyl dimethyl ammonium chloride, distearyl dimethyl ammonium chloride, dicetyl dimethyl ammonium chloride, di(behenyl/arachidyl) dimethyl ammonium chloride, dibehenyl dimethyl ammonium chloride, stearyl dimethyl benzyl ammonium chloride, stearyl propyleneglycol phosphate dimethyl ammonium chloride, stearoyl amidopropyl dimethyl benzyl ammonium chloride, stearoyl amidopropyl dimethyl (myristylacetate) ammonium chloride, and N-(stearoyl colamino formyl methy) pyridinium chloride.

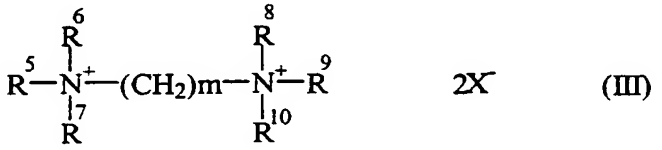
Also preferred are hydrophilically substituted cationic surfactants in which at least one of the substituents contain one or more aromatic, ether, ester,

amido, or amino moieties present as substituents or as linkages in the radical chain, wherein at least one of the R^1 - R^4 radicals contain one or more hydrophilic moieties selected from alkoxy (preferably C_1 - C_3 alkoxy), polyoxyalkylene (preferably C_1 - C_3 polyoxyalkylene), alkylamido, hydroxyalkyl, alkylester, and combinations thereof. Preferably, the hydrophilically substituted cationic conditioning surfactant contains from 2 to about 10 nonionic hydrophile moieties located within the above stated ranges. Preferred hydrophilically substituted cationic surfactants include those of the formula (II) through (VIII) below:



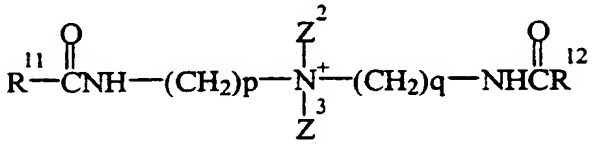
(II)

wherein n is from 8 to about 28, x+y is from 2 to about 40, Z^1 is a short chain alkyl, preferably a C_1 – C_3 alkyl, more preferably methyl, or $(CH_2CH_2O)_zH$ wherein x+y+z is up to 60, and X is a salt forming anion as defined above;

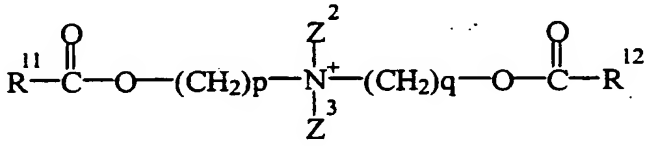


(III)

wherein m is 1 to 5, one or more of R^5, R^6, and R^7 are independently an C_1 - C_{30} alkyl, the remainder are CH_2CH_2OH, one or two of R^8, R^9, and R^{10} are independently an C_1 - C_{30} alkyl, and remainder are CH_2CH_2OH, and X is a salt forming anion as mentioned above;

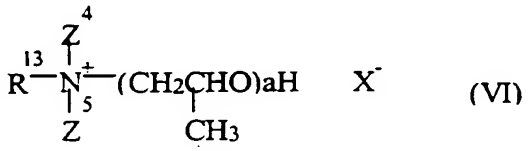


(IV)



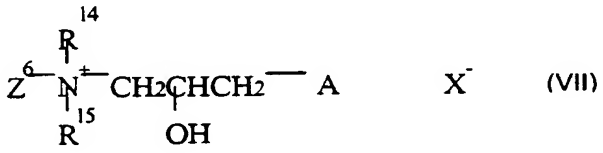
(V)

wherein, independently for formulae (IV) and (V), Z^2 is an alkyl, preferably a C_1 - C_3 alkyl, more preferably methyl, and Z^3 is a short chain hydroxyalkyl, preferably hydroxymethyl or hydroxyethyl, p and q independently are integers from 2 to 4, inclusive, preferably from 2 to 3, inclusive, more preferably 2, R^{11} and R^{12}, independently, are substituted or unsubstituted hydrocarbyls, preferably C_{12} - C_{20} alkyl or alkenyl, and X is a salt forming anion as defined above;



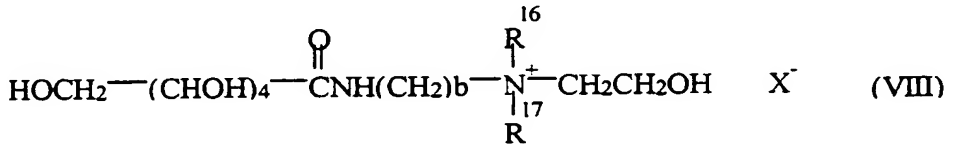
(VI)

wherein R^{13} is a hydrocarbyl, preferably a C_1 - C_3 alkyl, more preferably methyl, Z^4 and Z^5 are, independently, short chain hydrocarbyls, preferably C_2 - C_4 alkyl or alkenyl, more preferably ethyl, a is from 2 to about 40, preferably from about 7 to about 30, and X is a salt forming anion as defined above;



(VII)

wherein R^{14} and R^{15}, independently, are C_1 - C_3 alkyl, preferably methyl, Z^6 is a C_{12} - C_{22} hydrocarbyl, alkyl carboxy or alkylamido, and A is a protein, preferably a collagen, keratin, milk protein, silk, soy protein, wheat protein, or hydrolyzed forms thereof; and X is a salt forming anion as defined above;



(VIII)

wherein b is 2 or 3, R^{16} and R^{17}, independently are C_1 - C_3 hydrocarbyls preferably methyl, and X is a salt forming anion as defined above. Nonlimiting examples of hydrophilically substituted cationic surfactants useful in the present invention include the materials having the following CTFA designations: quaternium-16, quaternium-26, quaternium-27, quaternium-30, quaternium-33, quaternium-43, quaternium-52, quaternium-53, quaternium-56, quaternium-60,

quaternium-61, quaternium-62, quaternium-70, quaternium-71, quaternium-72, quaternium-75, quaternium-76 hydrolyzed collagen, quaternium-77, quaternium-78, quaternium-79 hydrolyzed collagen, quaternium-79 hydrolyzed keratin, quaternium-79 hydrolyzed milk protein, quaternium-79 hydrolyzed silk, quaternium-79 hydrolyzed soy protein, and quaternium-79 hydrolyzed wheat protein, quaternium-80, quaternium-81, quaternium-82, quaternium-83, quaternium-84, and mixtures thereof.

Highly preferred hydrophilically substituted cationic surfactants include dialkylamido ethyl hydroxyethylmonium salt, dialkylamidoethyl dimonium salt, dialkyloyl ethyl hydroxyethylmonium salt, dialkyloyl ethyldimonium salt, and mixtures thereof; for example, commerically available under the following tradenames; VARISOFT 110, VARIQUAT K1215 and 638 from Witco Chemical, MACKPRO KLP, MACKPRO WLW, MACKPRO MLP, MACKPRO NSP, MACKPRO NLW, MACKPRO WWP, MACKPRO NLP, MACKPRO SLP from McIntyre, ETHOQUAD 18/25, ETHOQUAD O/12PG, ETHOQUAD C/25, ETHOQUAD S/25, and ETHODUOQUAD from Akzo, DEHYQUAT SP from Henkel, and ATLAS G265 from ICI Americas.

Salts of primary, secondary, and tertiary fatty amines are also suitable cationic surfactants. The alkyl groups of such amines preferably have from about 12 to about 22 carbon atoms, and can be substituted or unsubstituted. Particularly useful are amidoamines of the following general formula:

$$R^1\ CONH\ (CH_2)_m\ N\ (R^2)_2$$

wherein R^1 is a residue of C_{11} to C_{24} fatty acids, R^2 is a C_1 to C_4 alkyl, and m is an integer from 1 to 4.

Preferred amidoamine useful in the present invention includes stearamidopropyldimethylamine, stearamidopropyldiethylamine, stearamidoethyldiethylamine, stearamidoethyldimethylamine, palmitamidopropyldimethylamine, palmitamidopropyldiethylamine, palmitamidoethyldiethylamine, palmitamidoethyldimethylamine, behenamidopropyldimethylamine, behenamidopropyldiethylamine, behenamidoethyldiethylamine, behenamidoethyldimethylamine, arachidamidopropyldimethylamine, arachidamidopropyldiethylamine, arachidamidoethyldiethylamine, arachidamidoethyldimethylamine, and mixtures thereof; more preferably stearamidopropyldimethylamine, stearamidoethyldiethylamine, and mixtures thereof.

The amidoamines herein are preferably used in combination with acids selected from the group consisting of L-glutamic acid, lactic acid, hydrochloric acid, malic acid, succinic acid, acetic acid, fumaric acid, L-glutamic acid hydrochloride, tartaric acid, and mixtures thereof; preferably L-glutamic acid, lactic acid, hydrochloric acid, and mixtures thereof. Preferably, the mole ratio of amidoamine to acid is from about 1:0.3 to about 1:1, more preferably from about 1:0.5 to about 1:0.9.

Cationic polymer

The cationic polymer can be included in the composition at a level by weight of, preferably from about 0.1% to about 10%, more preferably from about 0.25% to about 8%, still more preferably from about 0.5 to about 3%.

The cationic polymer useful herein is described below. As used herein, the term "polymer" shall include materials whether made by polymerization of one type of monomer or made by two (i.e., copolymers) or more types of monomers.

Preferably, the cationic polymer is a water-soluble cationic polymer. By "water soluble" cationic polymer, what is meant is a polymer which is sufficiently soluble in water to form a substantially clear solution to the naked eye at a concentration of 0.1% in water (distilled or equivalent) at 25°C. The preferred polymer will be sufficiently soluble to form a substantially clear solution at 0.5% concentration, more preferably at 1.0% concentration.

The cationic polymers hereof will generally have a weight average molecular weight which is at least about 5,000, typically at least about 10,000, and is less than about 10 million. Preferably, the molecular weight is from about 100,000 to about 2 million. The cationic polymers will generally have cationic nitrogen-containing moieties such as quaternary ammonium or cationic amino moieties, and mixtures thereof.

The cationic charge density is preferably at least about 0.1 meq/gram, more preferably at least about 1.5 meq/gram, even more preferably at least about 1.1 meq/gram, still more preferably at least about 1.2 meq/gram. Cationic charge density of the cationic polymer can be determined according to the Kjeldahl Method. Those skilled in the art will recognize that the charge density of amino-containing polymers may vary depending upon pH and the isoelectric point of the amino groups. The charge density should be within the above limits at the pH of intended use.

Any anionic counterions can be utilized for the cationic polymers so long as the water solubility criteria is met. Suitable counterions include halides (e.g., Cl, Br, I, or F, preferably Cl, Br, or I), sulfate, and methylsulfate. Others can also be used, as this list is not exclusive.

The cationic nitrogen-containing moiety will be present generally as a substituent, on a fraction of the total monomer units of the cationic hair conditioning polymers. Thus, the cationic polymer can comprise copolymers, terpolymers, etc. of quaternary ammonium or cationic amine-substituted monomer units and other non-cationic units referred to herein as spacer monomer units. Such polymers are known in the art, and a variety can be found in the CTFA Cosmetic Ingredient Dictionary, 3rd edition, edited by Estrin, Crosley, and Haynes, (The Cosmetic, Toiletry, and Fragrance Association, Inc., Washington, D.C., 1982).

Suitable cationic polymers include, for example, copolymers of vinyl monomers having cationic amine or quaternary ammonium functionalities with water soluble spacer monomers such as acrylamide, methacrylamide, alkyl and dialkyl acrylamides, alkyl and dialkyl methacrylamides, alkyl acrylate, alkyl methacrylate, vinyl caprolactone, and vinyl pyrrolidone. The alkyl and dialkyl substituted monomers preferably have C_1 - C_7 alkyl groups, more preferably C_1 - C_3 alkyl groups. Other suitable spacer monomers include vinyl esters, vinyl alcohol (made by hydrolysis of polyvinyl acetate), maleic anhydride, propylene glycol, and ethylene glycol.

The cationic amines can be primary, secondary, or tertiary amines, depending upon the particular species and the pH of the composition. In general, secondary and tertiary amines, especially tertiary amines, are preferred.

Amine-substituted vinyl monomers can be polymerized in the amine form, and then optionally can be converted to ammonium by a quaternization reaction. Amines can also be similarly quaternized subsequent to formation of the polymer. For example, tertiary amine functionalities can be quaternized by reaction with a salt of the formula R'X wherein R' is a short chain alkyl, preferably a C_1 - C_7 alkyl, more preferably a C_1 - C_3 alkyl, and X is an anion which forms a water soluble salt with the quaternized ammonium.

Suitable cationic amino and quaternary ammonium monomers include, for example, vinyl compounds substituted with dialkylaminoalkyl acrylate, dialkylaminoalkyl methacrylate, monoalkylaminoalkyl acrylate,

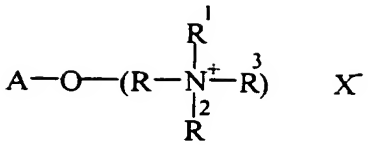
monoalkylaminoalkyl methacrylate, trialkyl methacryloxyalkyl ammonium salt, trialkyl acryloxyalkyl ammonium salt, diallyl quaternary ammonium salts, and vinyl quaternary ammonium monomers having cyclic cationic nitrogen-containing rings such as pyridinium, imidazolium, and quaternized pyrrolidone, e.g., alkyl vinyl imidazolium, alkyl vinyl pyridinium, alkyl vinyl pyrrolidone salts. The alkyl portions of these monomers are preferably lower alkyls such as the C_1 - C_3 alkyls, more preferably C_1 and C_2 alkyls. Suitable amine-substituted vinyl monomers for use herein include dialkylaminoalkyl acrylate, dialkylaminoalkyl methacrylate, dialkylaminoalkyl acrylamide, and dialkylaminoalkyl methacrylamide, wherein the alkyl groups are preferably C_1 - C_7 hydrocarbyls, more preferably C_1 - C_3, alkyls.

The cationic polymers hereof can comprise mixtures of monomer units derived from amine- and/or quaternary ammonium-substituted monomer and/or compatible spacer monomers.

Suitable cationic hair conditioning polymers include, for example: copolymers of 1-vinyl-2-pyrrolidone and 1-vinyl-3-methylimidazolium salt (e.g., chloride salt) (referred to in the industry by the Cosmetic, Toiletry, and Fragrance Association, "CTFA", as Polyquaternium-16), such as those commercially available from BASF Wyandotte Corp. (Parsippany, NJ, USA) under the LUVIQUAT tradename (e.g., LUVIQUAT FC 370); copolymers of 1-vinyl-2-pyrrolidone and dimethylaminoethyl methacrylate (referred to in the industry by CTFA as Polyquaternium-11) such as those commercially available from Gaf Corporation (Wayne, NJ, USA) under the GAFQUAT tradename (e.g., GAFQUAT 755N); cationic diallyl quaternary ammonium-containing polymers, including, for example, dimethyldiallylammonium chloride homopolymer and copolymers of acrylamide and dimethyldiallylammonium chloride, referred to in the industry (CTFA) as Polyquaternium 6 and Polyquaternium 7, respectively; and mineral acid salts of amino-alkyl esters of homo- and co-polymers of unsaturated carboxylic acids having from 3 to 5 carbon atoms, as described in U.S. Patent 4,009,256, incorporated herein by reference.

Other cationic polymers that can be used include polysaccharide polymers, such as cationic cellulose derivatives and cationic starch derivatives.

Cationic polysaccharide polymer materials suitable for use herein include those of the formula:



wherein: A is an anhydroglucose residual group, such as a starch or cellulose anhydroglucose residual, R is an alkylene oxyalkylene, polyoxyalkylene, or hydroxyalkylene group, or combination thereof, R^1, R^2, and R^3 independently are alkyl, aryl, alkylaryl, arylalkyl, alkoxyalkyl, or alkoxyaryl groups, each group containing up to about 18 carbon atoms, and the total number of carbon atoms for each cationic moiety (i.e., the sum of carbon atoms in R^1, R^2 and R^3) preferably being about 20 or less, and X is an anionic counterion, as previously described.

Cationic cellulose that can be used as a cationic polymer is different from the species disclosed above under the title "Hydrophobically modified cationic cellulose". The cationic cellulose useful herein is available from Amerchol Corp. (Edison, NJ, USA) in their Polymer JR® and LR® series of polymers, as salts of hydroxyethyl cellulose reacted with trimethyl ammonium substituted epoxide, referred to in the industry (CTFA) as Polyquaternium 10.

Other cationic polymers that can be used include cationic guar gum derivatives, such as guar hydroxypropyltrimonium chloride (commercially available from Celanese Corp. in their Jaguar R series). Other materials include quaternary nitrogen-containing cellulose ethers (e.g., as described in U.S. Patent 3,962,418, incorporated herein by reference), and copolymers of etherified cellulose and starch (e.g., as described in U.S. Patent 3,958,581, incorporated herein by reference.)

Silicone compound

The silicone compound can be included in the composition at a level by weight of, preferably from about 0.1% to about 10%, more preferably from about 0.25% to about 8%, still more preferably from about 0.5% to about 3%.

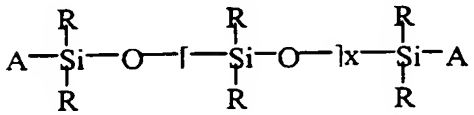
The silicone compounds hereof can include volatile soluble or insoluble, or nonvolatile soluble or insoluble silicone conditioning agents. By soluble what is meant is that the silicone compound is miscible with the carrier of the composition so as to form part of the same phase. By insoluble what is meant is that the silicone forms a separate, discontinuous phase from the carrier, such as in the form of an emulsion or a suspension of droplets of the silicone. The

silicone compounds herein may be made by conventional polymerization, or emulsion polymerization.

The silicone compounds for use herein will preferably have a viscosity of from about 1,000 to about 2,000,000 centistokes at 25°C, more preferably from about 10,000 to about 1,800,000, and even more preferably from about 25,000 to about 1,500,000. The viscosity can be measured by means of a glass capillary viscometer as set forth in Dow Corning Corporate Test Method CTM0004, July 20, 1970, which is incorporated by reference herein in its entirety. Silicone compound of high molecular weight may be made by emulsion polymerization.

Silicone compounds useful herein include polyalkyl polyaryl siloxanes, polyalkyleneoxide-modified siloxanes, silicone resins, amino-substituted siloxanes, and mixtures thereof. The silicone compound is preferably selected from the group consisting of polyalkyl polyaryl siloxanes, polyalkyleneoxide-modified siloxanes, silicone resins, and mixtures thereof, and more preferably from one or more polyalkyl polyaryl siloxanes.

Polyalkyl polyaryl siloxanes useful here in include those with the following structure (I)



(I)

wherein R is alkyl or aryl, and x is an integer from about 7 to about 8,000. "A" represents groups which block the ends of the silicone chains. The alkyl or aryl groups substituted on the siloxane chain (R) or at the ends of the siloxane chains (A) can have any structure as long as the resulting silicone remains fluid at room temperature, is dispersible, is neither irritating, toxic nor otherwise harmful when applied to the hair, is compatible with the other components of the composition, is chemically stable under normal use and storage conditions, and is capable of being deposited on and conditions the hair. Suitable A groups include hydroxy, methyl, methoxy, ethoxy, propoxy, and aryloxy. The two R groups on the silicon atom may represent the same group or different groups. Preferably, the two R groups represent the same group. Suitable R groups include methyl, ethyl, propyl, phenyl, methylphenyl and phenylmethyl. The preferred silicone compounds are polydimethylsiloxane, polydiethylsiloxane, and polymethylphenylsiloxane. Polydimethylsiloxane, which is also known as

dimethicone, is especially preferred. The polyalkylsiloxanes that can be used include, for example, polydimethylsiloxanes. These silicone compounds are available, for example, from the General Electric Company in their ViscasilR and SF 96 series, and from Dow Corning in their Dow Corning 200 series. Polymethylphenylsiloxanes, for example, from the General Electric Company as SF 1075 methyl phenyl fluid or from Dow Corning as 556 Cosmetic Grade Fluid, are useful herein.

Also preferred, for enhancing the shine characteristics of hair, are highly arylated silicone compounds, such as highly phenylated polyethyl silicone having refractive index of about 1.46 or higher, especially about 1.52 or higher. When these high refractive index silicone compounds are used, they should be mixed with a spreading agent, such as a surfactant or a silicone resin, as described below to decrease the surface tension and enhance the film forming ability of the material.

Another polyalkyl polyaryl siloxane that can be especially useful is a silicone gum. The term "silicone gum", as used herein, means a polyorganosiloxane material having a viscosity at 25°C of greater than or equal to 1,000,000 centistokes. It is recognized that the silicone gums described herein can also have some overlap with the above-disclosed silicone compounds. This overlap is not intended as a limitation on any of these materials. Silicone gums are described by Petrarch, and others including U.S. Patent No. 4,152,416, to Spitzer et al., issued May 1, 1979 and Noll, Walter, Chemistry and Technology of Silicones, New York: Academic Press 1968. Also describing silicone gums are General Electric Silicone Rubber Product Data Sheets SE 30, SE 33, SE 54 and SE 76. All of these described references are incorporated herein by reference in their entirety. The "silicone gums" will typically have a mass molecular weight in excess of about 200,000, generally between about 200,000 and about 1,000,000. Specific examples include polydimethylsiloxane, poly(dimethylsiloxane methylvinylsiloxane) copolymer, poly(dimethylsiloxane diphenylsiloxane methylvinylsiloxane) copolymer and mixtures thereof.

Polyalkyleneoxide-modified siloxanes useful herein include, for example, polypropylene oxide modified and polyethylene oxide modified polydimethylsiloxane. The ethylene oxide and polypropylene oxide level should be sufficiently low so as not to interfere with the dispersibility characteristics of the silicone. These material are also known as dimethicone copolyols.

Silicone resins, which are highly crosslinked polymeric siloxane systems, are useful herein. The crosslinking is introduced through the incorporation of tri-functional and tetra-functional silanes with mono-functional or di-functional, or both, silanes during manufacture of the silicone resin. As is well understood in the art, the degree of crosslinking that is required in order to result in a silicone resin will vary according to the specific silane units incorporated into the silicone resin. In general, silicone materials which have a sufficient level of trifunctional and tetrafunctional siloxane monomer units, and hence, a sufficient level of crosslinking, such that they dry down to a rigid, or hard, film are considered to be silicone resins. The ratio of oxygen atoms to silicon atoms is indicative of the level of crosslinking in a particular silicone material. Silicone materials which have at least about 1.1 oxygen atoms per silicon atom will generally be silicone resins herein. Preferably, the ratio of oxygen:silicon atoms is at least about 1.2:1.0. Silanes used in the manufacture of silicone resins include monomethyl-, dimethyl-, trimethyl-, monophenyl-, diphenyl-, methylphenyl-, monovinyl-, and methylvinylchlorosilanes, and tetrachlorosilane, with the methyl substituted silanes being most commonly utilized. Preferred resins are offered by General Electric as GE SS4230 and SS4267. Commercially available silicone resins will generally be supplied in a dissolved form in a low viscosity volatile or nonvolatile silicone fluid. The silicone resins for use herein should be supplied and incorporated into the present compositions in such dissolved form, as will be readily apparent to those skilled in the art. Without being bound by theory, it is believed that the silicone resins can enhance deposition of other silicone compounds on the hair and can enhance the glossiness of hair with high refractive index volumes.

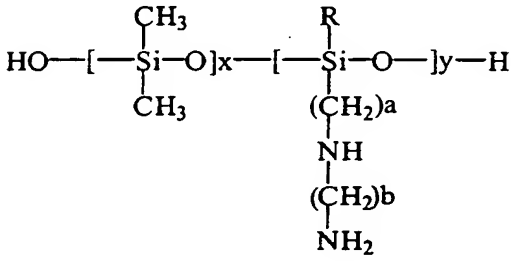
Other useful silicone resins are silicone resin powders such as the material given the CTFA designation polymethylsilsequioxane, which is commercially available as Tospearl™ from Toshiba Silicones.

Silicone resins can conveniently be identified according to a shorthand nomenclature system well known to those skilled in the art as the "MDTQ" nomenclature. Under this system, the silicone is described according to the presence of various siloxane monomer units which make up the silicone. Briefly, the symbol M denotes the mono-functional unit $(CH_3)_3SiO_{.5}$; D denotes the difunctional unit $(CH_3)_2SiO$; T denotes the trifunctional unit $(CH_3)SiO_{1.5}$; and Q denotes the quadri- or tetra-functional unit SiO_2. Primes of the unit symbols,

e.g., M', D', T', and Q' denote substituents other than methyl, and must be specifically defined for each occurrence. Typical alternate substituents include groups such as vinyl, phenyl, amino, hydroxyl, etc. The molar ratios of the various units, either in terms of subscripts to the symbols indicating the total number of each type of unit in the silicone, or an average thereof, or as specifically indicated ratios in combination with molecular weight, complete the description of the silicone material under the MDTQ system. Higher relative molar amounts of T, Q, T' and/or Q' to D, D', M and/or or M' in a silicone resin is indicative of higher levels of crosslinking. As discussed before, however, the overall level of crosslinking can also be indicated by the oxygen to silicon ratio.

The silicone resins for use herein which are preferred are MQ, MT, MTQ, MQ and MDTQ resins. Thus, the preferred silicone substituent is methyl. Especially preferred are MQ resins wherein the M:Q ratio is from about 0.5:1.0 to about 1.5:1.0 and the average molecular weight of the resin is from about 1000 to about 10,000.

Amino-substituted siloxanes useful herein include those represented by the following structure (II)



(II)

wherein R is CH_3 or OH, x and y are integers which depend on the molecular weight, the average molecular weight being approximately between 5,000 and 10,000. This polymer is also known as "amodimethicone".

Suitable amino-substituted siloxane fluids include those represented by the formula (III)

$$(R_1)_aG_{3-a}\text{-Si-}(\text{-OSiG}_2)_n\text{-}(\text{-OSiG}_b(R_1)_{2-b})_m\text{-O-SiG}_{3-a}(R_1)_a \qquad \text{(III)}$$

in which G is chosen from the group consisting of hydrogen, phenyl, OH, C_1-C_8 alkyl and preferably methyl; a denotes 0 or an integer from 1 to 3, and preferably equals 0; b denotes 0 or 1 and preferably equals 1; the sum n+m is a number from 1 to 2,000 and preferably from 50 to 150, n being able to denote a number from 0 to 1,999 and preferably from 49 to 149 and m being able to denote an

integer from 1 to 2,000 and preferably from 1 to 10; R_1 is a monovalent radical of formula $C_qH_{2q}L$ in which q is an integer from 2 to 8 and L is chosen from the groups

$-N(R_2)CH_2-CH_2-N(R_2)_2$

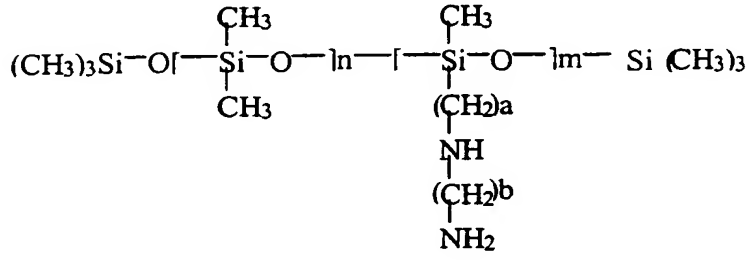
$-N(R_2)_2$

$-N(R_2)_3A^-$

$-N(R_2)CH_2-CH_2-NR_2H_2A^-$

in which R_2 is chosen from the group consisting of hydrogen, phenyl, benzyl, a saturated hydrocarbon radical, preferably an alkyl radical containing from 1 to 20 carbon atoms, and A^- denotes a halide ion.

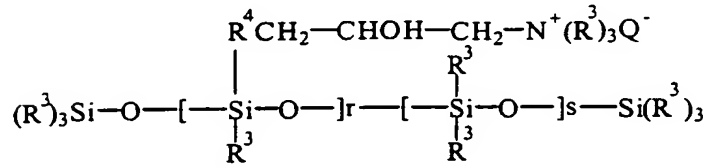
An especially preferred amino-substituted siloxane corresponding to formula (III) is the polymer known as "trimethylsilylamodimethicone", of formula (IV):



(IV)

In this formula n and m are selected depending on the molecular weight of the compound desired.

Other amino-substituted siloxane which can be used are represented by the formula (V):



(V)

where R^3 denotes a monovalent hydrocarbon radical having from 1 to 18 carbon atoms, preferably an alkyl or alkenyl radical such as methyl; R_4 denotes a hydrocarbon radical, preferably a $C_1 - C_{18}$ alkylene radical or a $C_1 - C_{18}$, and more preferably $C_1 - C_8$, alkyleneoxy radical; Q^- is a halide ion, preferably chloride; r denotes an average statistical value from 2 to 20, preferably from 2 to

8; s denotes an average statistical value from 20 to 200, and preferably from 20 to 50. A preferred polymer of this class is available from Union Carbide under the name "UCAR SILICONE ALE 56."

Cationic silicone emulsion

The hair conditioning composition of the present invention preferably comprises a cationic silicone emulsion as one of the conditioning agents, which is suitable for increasing in bulk hair volume while not deteriorating conditioning benefits such as fly-away control. The cationic silicone emulsion herein is a pre-dispersed stable emulsion, and comprises a cationic surfactant and a silicone compound. In the hair conditioning composition comprising the cationic silicone emulsion, the cationic surfactant is present in the silicone emulsion, and not just in the bulk of the composition.

The cationic surfactant and the silicone compound which is useful for comprising the silicone emulsion herein, are selected from the species disclosed above under the titles "Cationic surfactant" and "Silicone compound".

The cationic silicone emulsion comprises, by weight of the cationic silicone emulsion, preferably from about 1% to about 20%, more preferably from about 2% to about 8%, of the cationic surfactant; and an emulsifiable amount of the silicone compound, preferably from about 0.1% to about 70%, more preferably from about 5% to about 60%, of the silicone compound. The amount of silicone compound to the entire composition is preferably from about 0.1% to about 10% by weight.

The cationic silicone emulsion can be included in the composition at a level by weight of, preferably from about 0.1% to about 20%, more preferably from about 0.5% to about 5%.

The cationic silicone emulsion can be made by any convenient method known in the art.

For example, the cationic silicone emulsion may be made by mechanical emulsification by taking a polysiloxane polymer and emulsifying it in water in the presence of at least one emulsifying agent using mechanical means such as agitation, shaking and homogenization. The emulsifying agent can be the cationic surfactant comprised in the cationic silicone emulsion, or other suitable surfactant. Mechanical emulsification may require use of two or more surfactants, and two or more mixing processes using different surfactants. Two or more types of silicone compounds, such as a highly viscous silicone

compound and a low viscosity silicone compound, may be used. One particularly preferred process for obtaining the cationic silicone emulsion of the present invention via mechanical emulsification is through the process disclosed in EP Publication 460,683A, which is incorporated herein by reference in its entirety. In this reference, it is disclosed that the emulsion is prepared by combining the polysiloxane, water, and a primary nonionic surfactant having an HLB value of 15-19 to form a first mixture, adding to the first mixture a co-surfactant selected from the group consisting of nonionic, cationic and anionic surfactants having an HLB value of 1.8-15 to form a second mixture and mixing the second mixture at a temperature of about 40°C, until the particle size of the polysiloxane in the emulsion is less than about three hundred nanometers.

The cationic silicone emulsion herein may be made by emulsion polymerization. An emulsion polymerization process includes taking a polysiloxane monomer and/or oligomer and emulsifying it in water in the presence of a catalyst to form the polysiloxane polymer. It is understood that unreacted monomers and oligomers may remain in an emulsion polymerized silicone emulsion. One particularly preferred process for obtaining the cationic silicone emulsion of the present invention via emulsion polymerization is through the process disclosed in GB application 2,303,857, which is incorporated herein by reference in its entirety. This reference discloses a process for making stable cationic silicone oil-in-water emulsion comprising: 1) blending a mixture of silicones selected from the group consisting of cyclic silicone oligomers, mixed silicone hydrolyzates, silanol stopped oligomers, high molecular weight silicone polymers, and functionalized silicones with 2) water, and 3) an anionic surfactant; 4) heating the blend to a temperature ranging from about 75 to about 98°C for a period of time ranging from about 1 hours to about 5 hours; 5) cooling the heated blend to a temperature ranging from 0 to about 25°C for a period of time ranging from about 3 hours to about 24 hours; 6) adding a compatibilizing surfactant selected from the group consisting of nonionic surfactant having an HLB ratio greater than 9; and 7) adding a cationic surfactant.

Preferably the silicone compound in the cationic silicone emulsion has a particle size of less than about 50 microns, more preferably from about 0.2 to about 2.5 microns, still more preferably from about 0.2 to about 0.5 microns. The particle size of the silicone compound is believed to affect the deposition of the silicone compound on the hair. The particle size of the silicone compound is

determined based on the desired deposition and uniformity of distribution of the silicone compound.

The silicone particle size herein is measured by a laser analyzing equipment using Coulter Model N4SD available from Coulter Electronics, Inc. (Hialeah, FL, U.S.A.) using a spectrophotometer containing a Laser 4mW helium neon (632.8nm) and RS-232C serial interface. The particle size is analyzed via unimodal fit.

AQUEOUS CARRIER

The composition of the present invention comprises an aqueous carrier. The level and species of the carrier are selected according to the compatibility with other components, and other desired characteristic of the product.

The carrier useful in the present invention include water and water solutions of lower alkyl alcohols and polyhydric alcohols. The lower alkyl alcohol useful herein are monohydric alcohols having 1 to 6 carbons, more preferably ethanol and isopropanol. The polyhydric alcohols useful herein include propylene glycol, hexylene glycol, glycerin, and propane diol.

Preferably, the aqueous carrier is substantially water. Deionized water is preferably used. Water from natural sources including mineral cations can also be used, depending on the desired characteristic of the product. Generally, the compositions of the present invention comprise from about 20% to about 95%, preferably from about 30% to about 92%, and more preferably from about 50% to about 90% water.

ADDITIONAL COMPONENTS

The composition of the present invention may include other additional components, which may be selected by the artisan according to the desired characteristics of the final product and which are suitable for rendering the composition more cosmetically or aesthetically acceptable or to provide them with additional usage benefits. Such other additional components generally are used individually at levels of from about 0.001% to about 10%, preferably up to about 5% by weight of the composition.

A wide variety of other additional components can be formulated into the present compositions. These include: other conditioning agents such as hydrolysed collagen with tradename Peptein 2000 available from Hormel, vitamin E with tradename Emix-d available from Eisai, panthenol available from Roche, panthenyl ethyl ether available from Roche, a mixture of Polysorbate 60 and

Cetearyl Alcohol with tradename Polawax NF available from Croda Chemicals, glycerylmonostearate available from Stepan Chemicals, hydroxyethyl cellulose available from Aqualon, hydrolysed keratin, proteins, plant extracts, and nutrients; hair-fixative polymers such as amphoteric fixative polymers, cationic fixative polymers, anionic fixative polymers, nonionic fixative polymers, and silicone grafted copolymers; preservatives such as benzyl alcohol, methyl paraben, propyl paraben and imidazolidinyl urea; pH adjusting agents, such as citric acid, sodium citrate, succinic acid, phosphoric acid, sodium hydroxide, sodium carbonate; salts, in general, such as potassium acetate and sodium chloride; coloring agents, such as any of the FD&C or D&C dyes; hair oxidizing (bleaching) agents, such as hydrogen peroxide, perborate and persulfate salts; hair reducing agents such as the thioglycolates; perfumes; and sequestering agents, such as disodium ethylenediamine tetra-acetate; ultraviolet and infrared screening and absorbing agents such as octyl salicylate, antidandruff agents such as zinc pyridinethione; and optical brighteners, for example polystyrylstilbenes, triazinstilbenes, hydroxycoumarins, aminocoumarins, triazoles, pyrazolines, oxazoles, pyrenes, porphyrins, imidazoles, and mixtures thereof.

Polyethylene glycol can also be used as a additional component. The polyethylene glycols useful herein that are especially preferred are PEG-2M wherein n has an average value of about 2,000 (PEG-2M is also known as Polyox WSR® N-10 from Union Carbide and as PEG-2,000); PEG-5M wherein n has an average value of about 5,000 (PEG-5M is also known as Polyox WSR® N-35 and as Polyox WSR® N-80, both from Union Carbide and as PEG-5,000 and Polyethylene Glycol 300,000); PEG-7M wherein n has an average value of about 7,000 (PEG-7M is also known as Polyox WSR® N-750 from Union Carbide); PEG-9M wherein n has an average value of about 9,000 (PEG-9M is also known as Polyox WSR® N-3333 from Union Carbide); and PEG-14M wherein n has an average value of about 14,000 (PEG-14M is also known as Polyox WSR® N-3000 from Union Carbide).

Polypropylene glycol can also be used as a additional component. The polypropylene glycol useful herein is readily available from, for example, Sanyo Kasei (Osaka, Japan) as New pol PP-2000, New pol PP-4000, New pol GP-4000, and New pol SP-4000, from Dow Chemicals (Midland, Michigan, USA), from Calgon Chemical, Inc. (Skokie, Illinois, USA), from Arco Chemical Co.

(Newton Square Pennsylvania, USA), from Witco Chemicals Corp. (Greenwich, Connecticut, USA), and from PPG Specialty Chemicals (Gurnee, Illinois, USA).

INSTRON VOLUME MEASUREMENT METHOD

The Instron Volume Measurement Method is designed to analyze a bulk hair volume of a hair sample by Volume Index which is calculated from a tensile work when the hair sample is pulled up and goes through a ring hole. The tensile work correlates with bulk hair volume, as more tensile work should be needed in proportion to increase in bulk hair volume when the hair sample is pulled up and goes through the ring hole having a fixed diameter.

The hair conditioning compositions of the present invention provide a significant, noticeable increase in the bulk hair volume. This increase in the bulk hair volume is assessed by Volume Index, and the hair conditioning composition of the present invention has a Volume Index of 20 or greater, preferably 25 or greater, more preferably 30 or greater, as measured by the method described below.

The phrase "increase in the bulk hair volume" as used herein is not equal to fly-away hair. Fly-away hair is due to the increased level of static, and represents volume increase of only very minor amount of the hair as a whole, and is not desirable. On the other hand, increase in the bulk hair volume as used herein relates to volume increase of the hair as a whole while controlling fly-away of the hair.

Referring to the drawing, Fig. 1 shows a side view of a preferred embodiment of the Instron Volume Measurement Equipment useful herein. The Instron Volume Measurement Equipment consists of Mini Instron tensile tester MN 55 with Merlin Profiler soft ware (hereinafter tensile tester; available from Instron Computer), 1, and a stage, 6. The tensile tester, 1, comprises an Instron load cell, 2, a string, 3, and a sample holder, 4. The sample holder, 4, is typically a clip or clamp which stably suspends a hair sample, 7. The stage, 6, has a ring hole, 5, in the center.

The tensile tester, 1, measures a tensile strength when the hair sample, 7, goes through the ring hole, 5, by pulled up by the Instron load cell, 2, with the string, 3, and the sample holder, 4.

The stage, 6, has an adequate height so that the hair sample, 7, does not touch the base when the hair sample is placed on the sample holder, 4. The ring

hole, 5, has an adequate diameter to measure the tensile strength, for example, in this embodiment, the ring hole of the stage has a diameter of 35mm.

Preferably, this equipment should be located away from air currents or other forces which would disturb the hair sample, and is in a controlled temperature and humidity environment, so as to ensure repeatable results.

The hair sample, 7, typically consists of 20 cm (8 g) straight brown Caucasian hair switches (available from International Hair Importers & products Inc. of Bellerose, New York, USA). However, the hair volume increase benefits of the present invention are applicable to all types of hair samples. Further, it has been shown that the results achieved with hair samples are comparable to the results achieved during actual use on people.

The hair sample, 7, is prepared as follows:

For initial hair samples

1) Wet hair sample with 0 grain water and then apply 12% ammonium lauryl sulfate solution (0.1g per 1g hair) to the hair sample to strip the hair of soil.
2) Lather for 30 seconds and rinse for 30 seconds (The same washing condition should be used, including water temperature, water flow rate, and water hardness).
3) Apply 12% ammonium lauryl sulfate solution (0.1g per 1g hair) to the hair sample.
4) Lather for 30 seconds and rinse the hair sample for 60 seconds.
5) Comb wet hair sample through to remove tangles.
6) Squeeze off excess water from the hair sample and make the hair sample flat rectangular shape.
7) Leave the hair sample in a 25 °C / 50% relative humidity room and dry for 24 hours.

For treated hair samples

1) Wet hair sample obtained above with 0 grain water and then apply 0.1ml sample shampoo per 1g hair.
2) Lather for 30 seconds and rinse for 30seconds.
3) Apply 0.1ml sample shampoo per 1g hair.
4) Lather for 30 seconds and rinse for 60 seconds.
5) For conditioning ; apply 0.1ml sample conditioner per 1g hair for 30 seconds, comb for 15 seconds, and rinse for 30 seconds.

6) Squeeze off excess water from the hair sample and make the hair sample flat rectangular shape.

7) Leave the hair sample in a 25 °C / 50% relative humidity room and dry for 24 hours.

The sample shampoo used herein is Prell shampoo (current commercial non-conditioning shampoo marketed in the U.S.) or the shampoo composition of "Shamp. 1" described in Examples. The sample conditioner used herein is one of the conditioning composition of "Cond. 1" through "Cond. 7" described in Examples.

Typically, the same hair sample is first measured as an "initial hair sample", and then measured as a "treated hair sample", both initial and treated hair sample are prepared according to the procedure described above.

Once a hair sample (either initial or treated) is prepared, the hair sample is combed through 7 times, and then fixed in the sample holder, 4, through the ring hole, 5, of the stage, 6. The distance from the sample holder, 4, to the ring hole, 5, should be the same for each measurement.

Then the Instron load cell, 2, moves up to an adequate height from the base, the hair sample, 7, is pulled up by the Instron load cell, 2, through the string, 3, and the sample holder, 4 (pulling speed: 4mm/sec). When the hair sample is pulled up, the hair sample goes through the ring hole, 5. A tensile strength is measured by Merlin Profiler Software, when the hair sample goes through the ring hole, 5.

The measurement is repeated three times for a hair sample (either initial or treated), and 3 hair samples are used for the same treatment using the same shampoo and/or the same conditioner. Therefore a total of nine measurement for treated hair samples and a total of nine measurement for initial hair samples are conducted for the same treatment.

The data of the tensile strength is transferred into a computer to calculating a tensile work for an adequate distance, preferably for the first 8 cm of the hair sample. The calculation is done using the following equations:

$$\text{Tensile Work (mJ)} = \int_{x=0}^{x=D} F\,dx$$

wherein F is a extension load of the Instron load cell when the hair sample is pulled on distance x through the ring hole; and D is a length of the hair sample used for measurement.

The difference between the tensile work for the treated and initial hair samples is then calculated. The calculation is done using the following equations:

$$\Delta = Work_{treated} - Work_{initial}$$

The differences are calculated for each 9 measurements for the same treatment, and then combined to produce an average of tensile work per the same treatment ($\Delta_{treatment}$).

The above actual tensile work data($\Delta_{treatment}$) are converted into Volume Index, based on the tensile work data obtained for the top volume control treatment ($\Delta_{top\ volume}$) and for the bottom volume control treatment ($\Delta_{bottom\ volume}$). The top volume control treatment is a treatment, which is below described in Examples as "Treat. 1", using Prell shampoo (current commercial non-conditioning shampoo marketed in the U.S.) without any conditioner. The bottom volume control treatment is a treatment, which is below described in Examples as "Treat. 2", using a shampoo and a conditioner both below described in Examples as "Shamp. 1" and "Cond. 1". The conversion is done using the following equations:

$$\text{Volume Index} = 100 \times \frac{\Delta_{treatment} - \Delta_{bottom\ volume\ control}}{\Delta_{top\ volume\ control} - \Delta_{bottom\ volume\ control}}$$

EXAMPLES

The following examples further describe and demonstrate embodiments within the scope of the present invention. The examples are given solely for the purpose of illustration and are not to be construed as limitations of the present invention, as many variations thereof are possible without departing from the spirit and scope of the invention. Ingredients are identified by chemical or CTFA name, or otherwise defined below.

The compositions of the present invention are suitable for rinse-off products and leave-on products, and are particularly useful for making products in the form of emulsion, cream, gel, spray or, mousse.

"Shamp. 1" is a shampoo composition used for treatment for calculating Volume Index.

"Cond. 1" is a hair conditioning composition used for treatment for calculating Volume Index.

"Cond. 2" through "Cond. 7" are hair conditioning compositions of the present invention which are particularly useful for rinse-off use.

"Treat. 1" is the top volume control treatment, using Prell (current commercial non conditioning shampoo marketed in the U.S.) without conditioner application, for calculating Volume Index.

"Treat. 2" is the bottom volume control treatment, using a shampoo ("Shamp. 1") and a conditioner without hydrophobically modified cationic cellulose ("Cond. 1"), for calculating Volume Index.

"Treat. 3" through "Treat. 8" are treatments using the same shampoo ("Shamp. 1") and different conditioners ("Cond. 2" through "Cond. 7") of the present invention, for calculating Volume Index.

Compositions
[Shampoo]

Components	Shamp. 1
Ammonium Laureth-3 Sulfate	15
Ammonium lauryl sulfate	5
Ammonium xylene sulfonate	0.40
Silicone blend *1	0.50
Cetyl Alcohol *2	0.42
Stearyl alcohol *3	0.18
Cocamide MEA *4	0.85
Perfume	0.5
Kathon CG	0.05
Citric acid	0.1
Sodium Citrate dihydrate	1.00
Tetra sodium EDTA	0.016
Sodium benzoate	0.25
Panthenol *13	0.03
Panthenyl Ethyl Ether *14	0.25
NaCl	4.00
Deionized Water	q.s. to 100%

[Conditioner]

Components	Cond. 1	Cond. 2	Cond. 3	Cond. 4
Hydrophobically modified cationic cellulose * 5	-	0.50	0.10	0.25
Cationic Silicone Emulsion *6	-	-	0.69	-
Silicone Blend *1	2.52	2.52	-	2.52
Cetyl Alcohol *2	1.5	1.5	1.5	1.5
Stearyl Alcohol *3	2.7	2.7	2.7	2.7
Stearamidopropyl Dimethylamine *8	1.2	1.2	1.2	1.2
ℓ-Glutamic Acid *9	0.384	0.384	0.384	0.384
Polypropylene glycol *10	-	0.10	0.20	0.10
Preservatives	0.033	0.033	0.033	0.033
Benzyl alcohol	0.4	0.4	0.4	0.4

Perfume	0.6	0.6	0.6	0.6
Hydrolyzed collagen *11	0.01	0.01	0.01	0.01
Vitamin E *12	0.01	0.01	0.01	0.01
Panthenol *13	0.05	0.05	0.05	0.05
Panthenyl Ethyl Ether *14	0.05	0.05	0.05	0.05
Octyl methoxycinnamate	0.09	0.09	0.09	0.09
Benzophenone-3	0.09	0.09	0.09	0.09
dl-Alpha tocopherol acetate	0.03	0.03	0.03	0.03
Citric Acid *15	amount necessary to adjust pH 3-7			
Deionized Water	q.s. to 100%			

[Conditioner]

Components	Cond. 5	Cond. 6	Cond. 7
Hydrophobically modified cationic cellulose * 5	0.50	0.25	0.50
Silicone Blend *1	4.20	2.52	3.0
Cetyl Alcohol *2	4.5	1.2	0.7
Stearyl Alcohol *3	1.5	0.8	0.5
Behenyl Alcohol *7	-	-	0.1
Stearamidopropyl Dimethylamine *8	2.0	1.0	0.75
ℓ-Glutamic Acid *9	0.64	-	-
Ditallow dimethyl ammonium chloride *16	-	0.75	0.75
Pentaerythritol Tetraisostearate *17	1.0	0.2	0.10
Pentaerythritol Tetraoleate *18	-	0.10	0.25
Oleyl alcohol *19	-	0.1	0.25
PEG 2M *20	-	0.25	0.5
Polypropylene glycol *10	0.1	0.10	0.20
Polysorbate *21	-	0.125	0.125
Glycerylmonostearate *22	-	0.25	0.25
Preservatives	0.033	0.04	0.04
Benzyl alcohol	0.4	0.4	0.4
Perfume	0.6	0.6	0.6
Acid EDTA	0.01	0.02	0.01
Hydrolyzed collagen *11	0.01	0.01	0.01
Vitamin E *12	0.01	0.01	0.01
Panthenol *13	0.05	0.1	0.05

Panthenyl Ethyl Ether *14	0.05	0.01	0.05
Octyl methoxycinnamate	0.09	0.09	0.09
Benzophenone-3	0.09	0.09	0.09
dl-Alpha tocopherol acetate	0.03	0.03	0.03
Citric Acid *15	amount necessary to adjust pH 3-7		
Deionized Water	q.s. to 100%		

[Treatment]

	Treat. 1	Treat. 2	Treat. 3	Treat. 4
Shampoo	Prell	Sham. 1	Sham. 1	Sham. 1
Conditioner	-	Cond. 1	Cond. 2	Cond. 3
Volume Index	100	0	68.6	21.0

	Treat. 5	Treat. 6	Treat. 7	Treat. 8
Shampoo	Sham. 1	Sham. 1	Sham. 1	Sham. 1
Conditioner	Cond. 4	Cond. 5	Cond. 6	Cond. 7
Volume Index	29.0	46.0	26.2	48.0

Definitions of Components

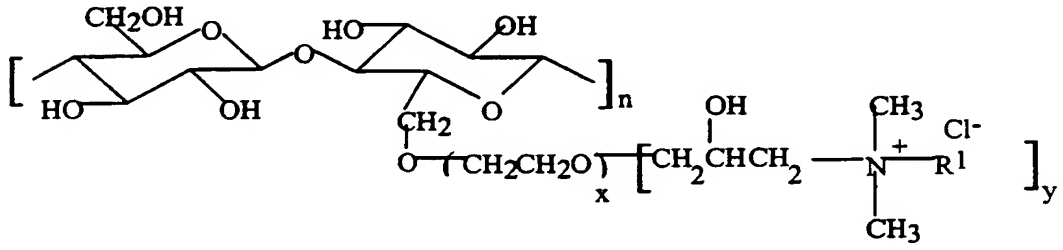
*1 Silicone Blend: SE 76 available from General Electric

*2 Cetyl Alcohol: Konol series available from Shin Nihon Rika.

*3 Stearyl Alcohol: Konol series available from Shin Nihon Rika.

*4 Cocamidopropylbetaine: Tego Betaine F available from TH Goldschmidt

*5 Hydrophobically modified cationic cellulose: Quaterisoft Polymer LM 200 available from Amerchol, which has the following formula



n = about 1,000
x = 25 - 300
y = 0.4
molecular weight = 250,000 - 300,000

*6 Cationic Silicone Emulsion: PE2016 available from Dow Corning; is mechanically emulsified emulsion containing 55% silicone compound and 3.0% cationic surfactant, wherein the silicone compound has a particle size of about 280 nm, and is made by using polydimethylsiloxane having about 900 repeating units and polydimethylsiloxane having about 100 repeating units, in a ratio of 27:73.

*7 Behenyl Alcohol: 1-Docosanol (97%) available from Wako.

*8 Stearamidopropyl Dimethylamine: Amidoamine MPS available from Nikko.

*9 ℓ-Glutamic Acid: ℓ-Glutamic acid (cosmetic grade) available from Ajinomoto.

*10 Polypropylene glycol: New pol PP-2000 available from Sanyo Kasei.

*11 Hydrolyzed collagen: Peptein 2000 available from Hormel.

*12 Vitamin E: Emix-d available from Eisai.

*13 Panthenol: available from Roche.

*14 Panthenyl Ethyl Ether: available from Roche.

*15 Citric Acid: Anhydrous Citric acid available from Haarman & Reimer.

*16 Ditallow dimethyl ammonium chloride: available from Witco Chemicals.

*17 Pentaerythritol Tetraisostearate: KAK PTI available from Kokyu alcohol.

*18 Pentaerythritol Tetraoleate: available from Shin Nihon Rika.

*19 Oleyl alcohol: available from New Japan Chemicals.

*20 PEG 2M: Polyox available from Union Carbide.

*21 Polysorbate: available from Croda Chemicals.

*22 Glycerylmonostearate: available from Stepan Chemicals.

Method of Preparation

The shampoo composition of "Shamp. 1" as shown above can be prepared by any conventional method well known in the art. Suitable methods are described below.

Polymers and surfactants are dispersed in water to form a homogenous mixture. To this mixture are added the other ingredients except for perfume and salt; the obtained mixture is agitated. The obtained mixture is then passed through a heat exchanger to cool, and then, perfume and salt are added. The obtained compositions are poured into bottles to make hair shampoo compositions. Alternatively, water and surfactants and any other solids that need to be melted can be mixed together at elevated temperature, e.g., above about 70°C, to speed the mixing into shampoo. Additional ingredients can be added either to this hot premix or after cooling the premix. The ingredients are

mixed thoroughly at the elevated temperature and then pumped through a high shear mill and then through a heat exchanger to cool them to ambient temperature. Then the cationic silicone emulsion is added at room temperature to the cooled mix and mixed well.

The hair conditioning compositions of "Cond. 1" through "Cond. 7" as shown above can be prepared by any conventional method well known in the art. They are suitably made as follows: If included in the composition, polymeric materials such as hydrophobically modified cationic cellulose and polyethylene glycol are dispersed in water at room temperature to make a polymer solution, and heated up to above 70°C. Amidoamine and acid, or other cationic conditioning agents, and if present, ester oil of low melting point oil are added in the solution with agitation. Then high melting point fatty compound, and if present, other low melting point oils and benzyl alcohol are also added in the solution with agitation. The mixture thus obtained is cooled down to below 60°C, and if present, the remaining components such as cationic silicone emulsion are added with agitation, and further cooled down to about 30°C.

A triblender and/or mill can be used in each step, if necessary to disperse the materials.

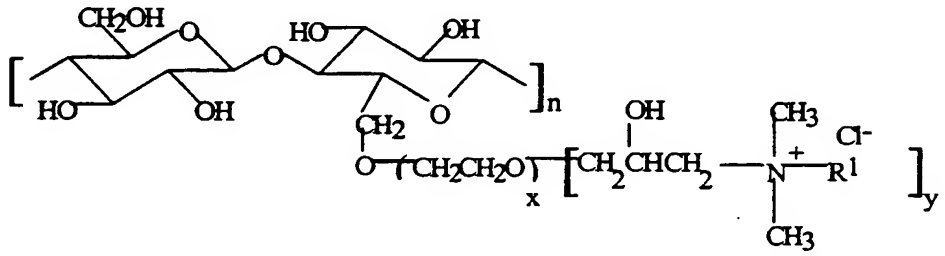
The embodiments disclosed and represented by the previous "Cond. 2" through "Cond. 7" have many advantages. For example, they can provide increase in bulk hair volume, softness, moisturized feel, and fly-away control.

It is understood that the examples and embodiments described herein are for illustrative purposes only and that various modifications or changes in light thereof will be suggested to one skilled in the art without departing from its spirit and scope.

What is claimed is:

1. A hair conditioning composition comprising by weight:

(a) from about 0.1% to about 5% of a hydrophobically modified cationic cellulose having the following formula:



wherein R^1 is an alkyl having from about 8 to about 22 carbons, n is an integer from 1 to about 4,000; x is 0 or an integer from 1 to about 6; y is the level of cationic substitution from 0.1 to 1.0; and having a molecular weight of no more than about 1,000,000;

(b) from about 0.01% to about 20% of a conditioning agent; and

(c) an aqueous carrier,

wherein the hair conditioning composition increases bulk hair volume by a Volume Index of 20 or greater as measured by Instron Volume Measurement Method.

2. The hair conditioning composition according to Claim 1 wherein the hydrophobically modified cationic cellulose has a molecular weight of from about 250,000 to about 500,000.

3. The hair conditioning composition according to Claim 1 wherein the conditioning agent is selected from the group consisting of a high melting point fatty compound having a melting point of 25°C or higher, a low melting point oil having a melting point of less than 25°C, a cationic surfactant, a cationic polymer, a silicone compound, a cationic silicone emulsion, and mixtures thereof.

4. The hair conditioning composition according to Claim 3 comprising the cationic silicone emulsion comprising, by weight of the cationic silicone emulsion, from about 1% to about 20% of the cationic surfactant; and an emulsifiable amount of the silicone compound having a particle size of less than about 50 microns.

5. The hair conditioning composition according to Claim 4 wherein the silicone compound has a particle size of from about 0.2 microns to about 2.5 microns.

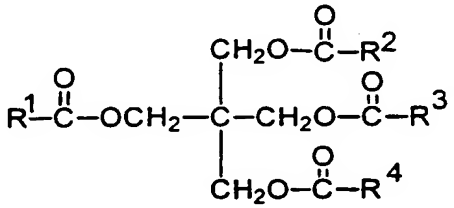
6. The hair conditioning composition according to Claim 3 comprising the high melting point fatty compound and the cationic surfactant.

7. The hair conditioning composition according to Claim 6 wherein the cationic surfactant comprises:
an amidoamine having the following general formula:

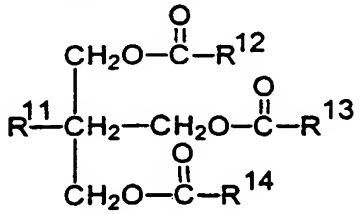
R^1 CONH $(CH_2)_m$ N $(R^2)_2$

wherein R^1 is a residue of C_{11} to C_{24} fatty acids, R^2 is a C_1 to C_4 alkyl, and m is an integer from 1 to 4; and
an acid selected from the group consisting of L-glutamic acid, lactic acid, hydrochloric acid, malic acid, succinic acid, acetic acid, fumaric acid, L-glutamic acid hydrochloride, tartaric acid, and mixtures thereof.

8. The hair conditioning composition according to Claim 3 comprising the low melting point oil selected from the group consisting of:
(a) pentaerythritol ester oils having a molecular weight of at least about 800, and having the following formula:



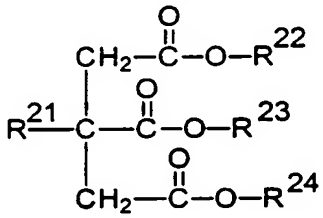
wherein R^1, R^2, R^3, and R^4, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 1 to about 30 carbons;
(b) trimethylol ester oils having a molecular weight of at least about 800, and having the following formula:



wherein R^{11} is an alkyl group having from 1 to about 30 carbons, and R^{12}, R^{13}, and R^{14}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 1 to about 30 carbons;

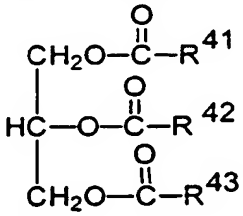
(c) poly α-olefin oils derived from 1-alkene monomers having from about 6 to about 16 carbons, the poly α-olefin oils having a viscosity of from about 1 to about 35,000 cst, a molecular weight of from about 200 to about 60,000, and a polydispersity of no more than about 3;

(d) citrate ester oils having a molecular weight of at least about 500, and having the following formula:



wherein R^{21} is OH or CH_3COO, and R^{22}, R^{23}, and R^{24}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 1 to about 30 carbons;

(e) glyceryl ester oils having a molecular weight of at least about 500, and having the following formula:



wherein R^{41}, R^{42}, and R^{43}, independently, are branched, straight, saturated, or unsaturated alkyl, aryl, and alkylaryl groups having from 1 to about 30 carbons; and mixtures thereof.

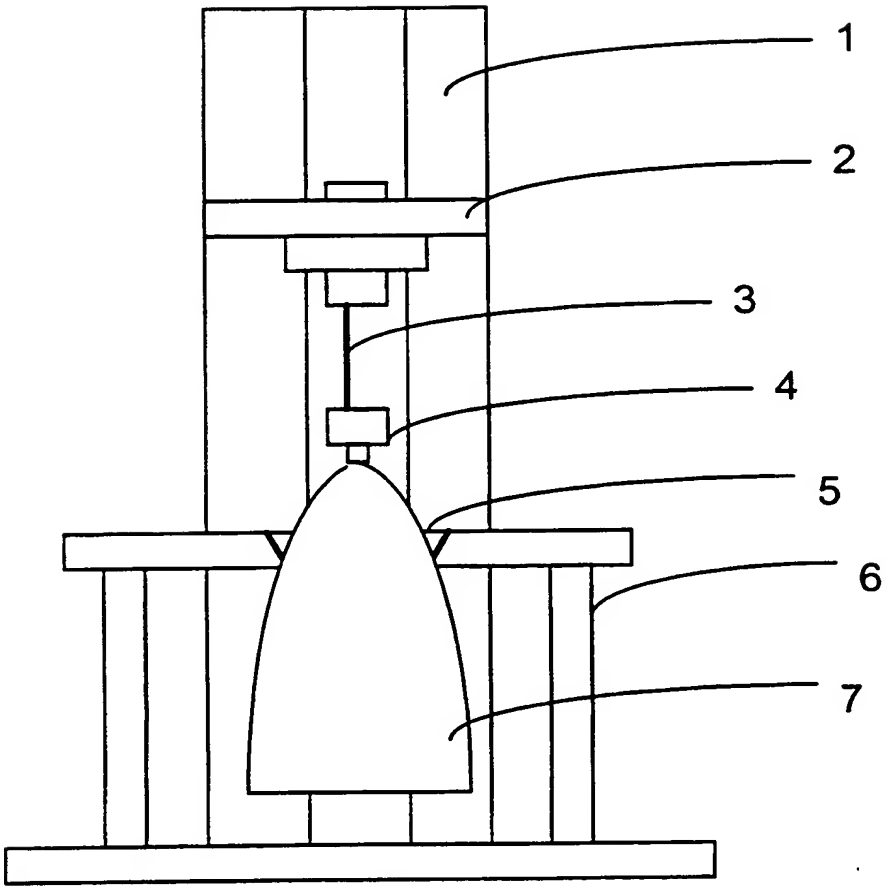


Fig. 1

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/US 99/26511

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61K7/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 807 545 A (CARBALLADA JOSE ANTONIO ET AL) 15 September 1998 (1998-09-15) claim 1; examples X-XIX	1-3
X	WO 92 16187 A (PROCTER & GAMBLE) 1 October 1992 (1992-10-01) claim 1; examples 12,14	1-3
X	WO 99 13833 A (PROCTER & GAMBLE) 25 March 1999 (1999-03-25) claim 1; examples X-XVI	1-3

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 July 2000	26/07/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Beyss, E

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

information on patent family members

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